

Pennsylvania

Height Modernization Forum

Report

July 16, 2004

Sponsored by the
**National Geodetic Survey and the
Pennsylvania Department of Transportation**

Co-sponsored by the
**United States Geological Survey and
Herbert, Rowland & Grubic, Inc.**

Introduction and Overview

Since 2003, representatives from state, local, and private interests in Pennsylvania have collaborated with the National Geodetic Survey (NGS) to learn how to improve the vertical component and densify the horizontal component of the geodetic network of the state through NOAA's Height Modernization Program (HMP). The specific goal of the Height Modernization Program is to provide elevations, obtained through the use of Global Positioning Systems (GPS) technology, that are accurate enough to support the positioning framework vital to the state's transportation, commerce, and emergency management activities.

On July 16, 2004, the Pennsylvania Department of Transportation (PennDOT) and NGS hosted the Pennsylvania Height Modernization Users Forum in New Cumberland, Pennsylvania, at facilities provided by the United States Geological Survey (USGS). Herbert, Rowland & Grubic, Inc. (HRG) co-sponsored the forum. The purpose of the forum was to inform participants of the needs and benefits of an accurate vertical reference system and to describe how Height Modernization improves height information efficiently and accurately. The 31 attendees included emergency managers, GIS/LIS professionals, surveyors, and others interested in geospatial activities.

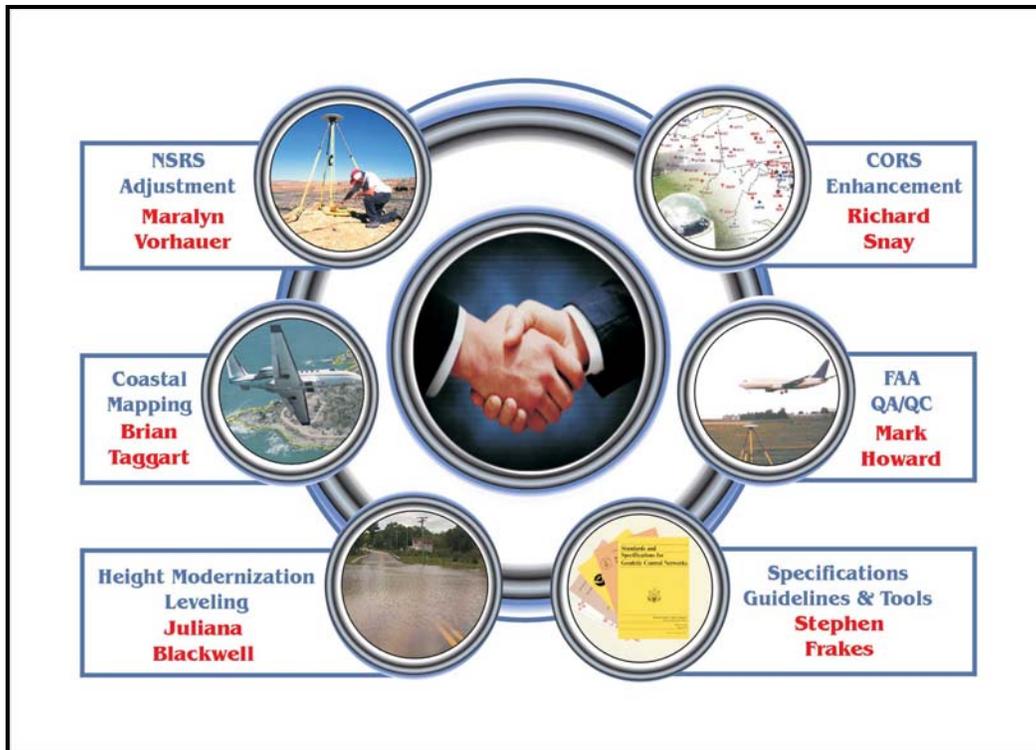
A number of speakers provided an overview of the HMP and described the applications to the state of Pennsylvania. Attendees had the opportunity to discuss issues, ask questions, and make suggestions on ways to develop Pennsylvania's Height Modernization program.

Presentations

National Height Modernization Program Overview ([PA HM Overview NGS 16 Jul 04.ppt](#))
Juliana Blackwell (NGS, Height Modernization Program Manager)

Ms. Blackwell led off the forum by providing an overview of NGS' programs and cooperative efforts. NGS' priorities include:

- ▶ National Spatial Reference System (NSRS) Adjustment,
- ▶ Coastal Mapping,
- ▶ Height Modernization and Leveling,
- ▶ Continuously Operating Reference Stations (CORS) Enhancement,
- ▶ Federal Aviation Administration (FAA) Quality Assurance and Control, and
- ▶ Specifications, Guidelines, and Tools.



NGS Priorities

Height Modernization integrates all of NGS’ priorities – CORS, NSRS, leveling, geoid modeling, tools, specifications, coastal mapping, transportation, and remote sensing.

In an overview of the Height Modernization Program (HMP) Ms. Blackwell described what Height Modernization is and why it is important. Height Modernization is the establishment of accurate, reliable heights using GPS technology in conjunction with traditional leveling, gravity, and modern remote sensing information. Height Modernization is a cost efficient way to update and improve elevation information. To date, eight states have received Congressional funding for Height Modernization: Alabama, California, Louisiana, Mississippi, North Carolina, South Carolina, Washington, and Wisconsin. Accurate and consistent height information serves as the foundation for improved transportation systems, subsidence monitoring, sea level rise estimation, floodplain mapping, urban planning, storm surge modeling, habitat restoration, emergency preparedness, resource management, site-specific farming, construction, mineral extraction, and seismic and infrastructure monitoring.

Ms. Blackwell briefly explained that elevations, or heights, are complicated because of the systems in which they are measured. For GPS, heights are referenced to an ellipsoid model and for traditional leveling heights are determined relative to “mean sea level.” The intermediary height is the geoid height. Each type of elevation information has error sources that Height Modernization techniques can reduce.

Examples of current projects include evacuation route surveys in Louisiana, subsidence monitoring in Houston-Galveston, a statewide survey plan for transportation needs in Wisconsin,

a Continuously Operating Reference Station (CORS) network to maintain continuous positioning capabilities in dynamic areas such as California, and the application of accurate height information to floodplain mapping updates in North Carolina in conjunction with the Federal Emergency Management Agency's (FEMA) Map Modernization effort.

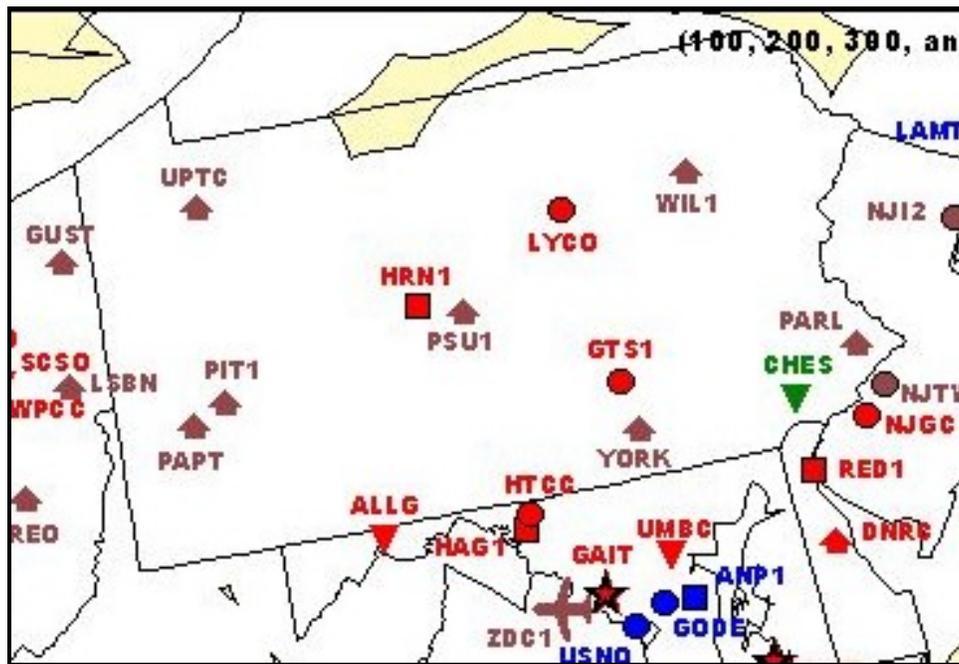
Pennsylvania Height Modernization ([Height Mod PA 7-2004.ppt](#))

Brad Foltz (Photogrammetry and Surveys Section, PennDOT)

Mr. Foltz presented background information on Pennsylvania's geodetic control network. Pennsylvania's 130 station Federal Base Network (FBN)/Cooperative Base Network (CBN) was completed in 2000, with FBN/CBN ties to adjacent states completed in 2003. The eleven CORS already constructed and used within the state assist with B-order and first-order monumentation, right-of-way monumentation, topographic survey control, construction control, Geographic Information Systems (GIS) base mapping, and airborne GPS. The less people and time required to establish geodetic control mean the more tax dollars are saved.

PennDOT operates seven (7) CORS, four at Pennsylvania State University (PSU) campuses and two at University of Pittsburgh campuses: PSU at Wilkes Barre (WIL1), PSU at University Park (PSU1), PSU at New Kensington (PIT1), PSU at Warminster ARL (PARL), University of Pittsburgh (PAPT), University of Pittsburgh at Titusville (UPTC), and PennDOT York County Maintenance Office (YORK).

Four (4) other CORS operated within the state include: Harrisburg (GTS1), Hawk Run 1 (HRN1), Lycoming County (LYCO), and the Cooperative CORS Chester County GIS (CHES).



Pennsylvania CORS

PennDOT's website www.penndotpams.org (supports Internet Explorer only at this time) utilizes a public map viewer to search and retrieve photos and existing survey control in the state. Data and projects from 1968 to present are available and include:

- Aerial Photography +700,000 exposures
- Projects +10,000
- Horizontal Survey Control +1,000
- Vertical Control +2,000

Why is Height Modernization important to Pennsylvania? Height Modernization establishes a standardized, legal, accurate, and economical way to gather and assimilate geospatial data. Applications of Height Modernization include floodplain mapping, regional and urban planning, erosion mapping, and transportation mapping. Of great importance is the accessibility and reliability of geodetic information obtained through Height Modernization.

Pennsylvania Height Modernization ([PA Height Modernization Forum.ppt](#))

James Knudson (State GIS Coordinator, Governor's Office of Administration)

As State GIS Coordinator, Mr. Knudson has a mandate to identify priorities for geospatial initiatives, e.g., the Pennsylvania statewide DEM and the Pennsylvania Map (PAMAP) Program.

Mr. Knudson commented that vertical and horizontal accuracy is important to all aspects of GIS and Geographic Technologies (GT). Pennsylvania is behind other states in many areas, but Height Modernization is one program in which the state can take a lead role. Digital Elevation Model (DEM) and Height Modernization projects will provide the basis for accurate orthophotography, flood mapping, surveying, GPS fieldwork, mine subsidence, and sinkhole monitoring.

Flooding is Pennsylvania's number one hazard. Improvements are needed on the current 30-meter state DEM that was created 10 years ago from elevation data from quad sheet contours during the 1970's. Some 10-meter DEM information exists but it is a resample of 30-meter resolution. The state standards call for 5-foot contours. This all impacts the Pennsylvania Flood Insurance Program, all hazards mapping, and river basin mapping and inundation models. Current GT state initiatives include PAMAP with a 3-year cycle for all counties in the state and DEM/Height Modernization for better mapping, accuracy, and plume modeling.

A value-added byproduct of Height Modernization is horizontal positioning (latitude and longitude) on marks. This additional survey control will benefit future development, including development of a statewide parcel map.

In conclusion, Mr. Knudson recommended the establishment of a GT/Height Modernization team comprised of representatives from NGS, PA state agencies, counties, professional land survey societies, vendors, and other interested parties. Elevation drives all field mapping, all imagery collection projects, and will support the DEM project. Pennsylvania has an opportunity to lead the region in the Height Modernization arena but has to have a great team to solve this problem.



PAMAP Imagery

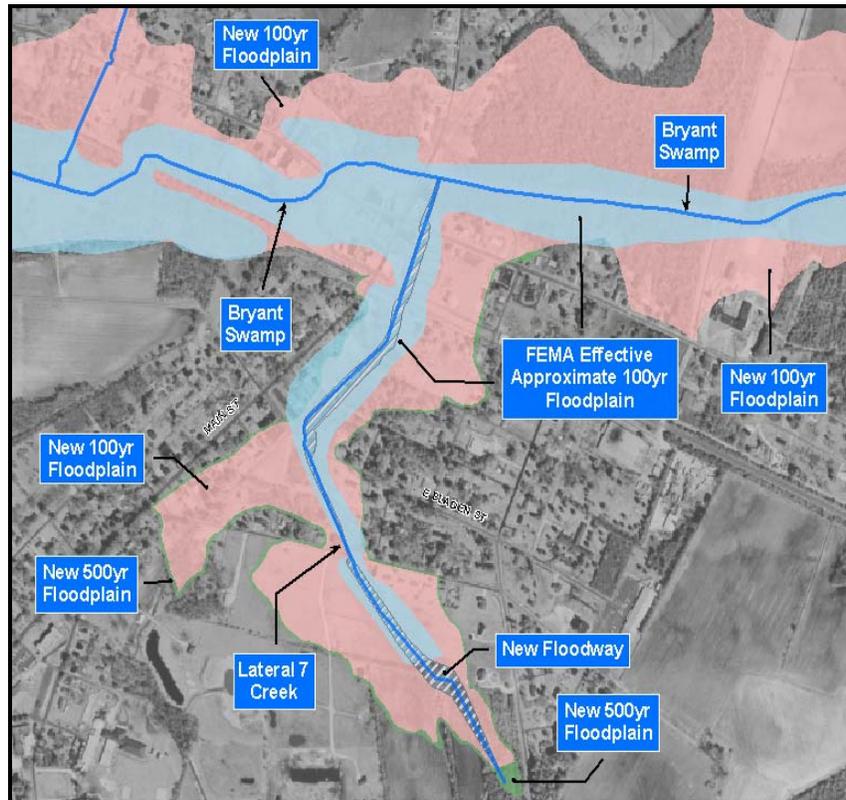
Focus Groups Activities

The last activity of the forum was to identify key issues of Height Modernization to discuss in small focus groups. Five groups of six persons spent an hour discussing their issue, laying out recommendations and concerns, and reporting their results to the larger group. The issues discussed were:

- Group 1: Cost Benefit Justification
- Group 2: Data Sharing & Priorities
- Group 3: Lead Agency and Coordination of Effort from Local to Federal Levels & Lessons Learned & Best Practices
- Group 4: “Big Tent Theory” – data dissemination to all potential users, use of “On-line Positioning User Service” for **project** submission (future “OPUS-for-projects”)
- Group 5: Funding for Height Modernization

Results of Focus Groups Discussions

Group 1: Cost Benefit Justification – The group was sold on the North Carolina example from the National Height Modernization Program Overview slide (shown below) which demonstrated the changes between the previous Effective Approximate 100 year floodplain (light blue) and the new 100 year floodplain (pink). The group reported that visual examples such as this are excellent justification for the needs for accurate elevations.



North Carolina (Bladen County) Floodplain Map Comparison

Group 2: Data Sharing & Priorities – Group 2 recommended PennDOT as the lead agency for Height Modernization in Pennsylvania with support and data dissemination from the Pennsylvania Department of Conservation and Natural Resources (DCNR). PennDOT could handle the contract administration and DCNR could provide data sheets, shapefiles, and GIS information. The group also recommended that Pennsylvania have an NGS State Geodetic Advisor.

Priorities listed by the group included:

- NGS State Geodetic Advisor to Pennsylvania
- Homeland Security – of the 133 cities designated in the United States that are key areas of concern, 5 of them are in Pennsylvania
- Flood areas and river basins
- Nuclear plants
- Events attracting large numbers of people
- Funding issues – flooding, security, sinkholes, subsidence, sediment

Group 3: Lead Agency and Coordination of Effort from Local to Federal Levels & Lesson Learned & Best Practices – The group recommended contacting other states to learn more about the objectives, costs, and path to realization of Height Modernization. The group also said that they would recommend simultaneously petitioning Congress for funding. This could be done through the Governor’s Office or Delegates. State and county agencies can also support the Height Modernization Program. Coordination is based on the result of “best practices” findings.

Group 4: “Big Tent Theory” – data dissemination to all potential users, use of online submission to NGS (future “OPUS-for-projects”) – Group 4 emphasized the need for simplified NGS submission procedures. All types and accuracies of survey and GIS data should be included (such as points and features).

Group 5: Funding for Height Modernization – The group had the following items to report:

- Acquiring funding at the local level is difficult.
- Funding for Height Modernization should come from the Federal and state governments for monumentation with management and coordination by NGS.
- Educating political leaders (State Governor, Senate & Legislative representatives) on the need for funding.
- Educating the public about the importance and need for accurate spatial data (because of everything that is related to it and affected by it). This will then get the attention of the elected officials and educate them as well.

Wrap-up

The remaining 15 minutes were spent discussing the coordination of the Height Modernization Program in Pennsylvania and answering remaining questions. A recommendation was made to involve the Office of Surface Mining (Department of Interior). The mapping of mines and the role of groundwater in mining areas are important issues to address in Pennsylvania.

Another suggestion was to focus the state coordination through Mr. James Knudson, the new GIS State Coordinator. Mr. Knudson was very interested in taking the information discussed at the forum back to the Governor’s Office and working toward a coordinated GPS/GIS effort to get Height Modernization started in Pennsylvania. No other states to the Northeast or bordering Pennsylvania have instituted a Height Modernization Program. If Height Modernization is implemented in the near future in Pennsylvania, the state could take on a leadership role in the Northeast Region. States that are currently leaders (California, Louisiana, North Carolina) demonstrate to nearby states, as well as distant states with common issues, the methods and best practices of their program through coordination meetings, participation in other user forums, assistance in developing an implementation plan, and sharing research ideas and lessons learned.

Lastly, participants questioned “if” and “how” to get the National Weather Service (NWS) linked to what is happening with Height Modernization. NGS responded that there have been some contacts made and that NGS is committed to improving our collaboration with other agencies within our own NOAA organization. Local and regional representatives of the NWS will be invited to future user forums.

Appendix A – Flyer for Height Modernization Forum

Why should you be concerned about updating Pennsylvania's vertical reference system?

A



Because accurate monuments are needed to support floodplain mapping updates and surveys

B



Because many benchmarks have been destroyed

C



Because accurate monuments will provide a consistent spatial reference system within the national framework

D



Because accurate monuments may be used to monitor subsidence from mining and karst topography

The answer is E, all of the above. For these reasons and many others, PENNDOT and the National Geodetic Survey are sponsoring the **Pennsylvania Height Modernization Users Forum** to inform you about the federal government's initiative for height modernization throughout the country. This information is important for anyone interested in accurate elevations, subsidence, flooding, and safe navigation by air and water.

What will be discussed at the users forum?

Description of the National Height Modernization Program and its benefits

Explanation of how height modernization can benefit Pennsylvanians

Case studies of successful height modernization projects

Where will it be?

USGS Conference Room
215 Limekiln Road
New Cumberland, PA

When will it be held?

Friday July 16, 2004

8:30 a.m. - 9:00 a.m. Welcome Reception

9:00 a.m. - 12:00 p.m. Users Forum

Because the event is *free* and seating is limited, you must notify us in advance if you plan to attend.

Please email your RSVP (and any questions you may have) to Brad Foltz at lbholtz@state.pa.us by July 2!

Feel free to forward this announcement to anyone else you think would be interested in attending this event.

The Pennsylvania Height Modernization Users Forum is sponsored by PENNDOT and the National Geodetic Survey.

Appendix B – List of Attendees

Name	Agency	Email
Alan Tamm	PEMA	atamm@state.pa.us
Barry C. Hutchins	County of Lycoming - Public Safety	bhutchin@epix.net
Brad Foltz	PENNDOT - Photogrammetry	bfoltz@state.pa.us
Brian Bills	Penn State	bbills@psu.edu
Chuck Ghilani	Penn State - Survey Program Chair	cghilani@psu.edu
Chuck Harpster	PENNDOT - Photogrammetry & Surveys	charpster@state.pa.us
David Kelly	Buchart Horn	dkelly@BH-BA.com
Derek Barker	Michael Baker	dbarker@mbakercorp.com
Donald Mulcare	National Geodetic Survey, NOAA	donald.mulcare@noaa.gov
Douglas Davis	T3 Global Strategies	ddavis@t3gs.com
Earl Clouser	Buchart Horn	eclouser@BH-BA.com
Ed Koerkle	USGS WRD	ekoerkle@usgs.gov
Eric Orndorff	Herbert, Rowland & Grubic, Inc.	eorndorff@hr-g-inc.com
Gary Milbrand	York Township, York County	g.milbrand@yorktownship.com
Gilbert Mitchell	National Geodetic Survey, NOAA	gilbert.mitchell@noaa.gov
Jay Parrish	DCNR - Topo Geo	jayparrish@state.pa.us
Jesse Kozlowski	Taylor Wiseman & Taylor	KozlowskiJ@TaylorWiseman.com
Jim Knudson	Governor's Office/GIS	jknudson@state.pa.us
John Stefanko	DEP/BAMR	jstefanko@state.pa.us
Juliana Blackwell	National Geodetic Survey, NOAA	juliana.blackwell@noaa.gov
Mike D'Angelo	D'angelo Surveying	MCDPLS@comcast.net
Mike Shillenn	BAE Systems/ADR	mshillenn@adrinc.com
Paul Hayes	York County Planning Commission	phayes@ycpc.org
Rob Rowe	Herbert, Rowland & Grubic, Inc.	rrowe@hr-g-inc.com
Skip Walls	Lancaster County - Wide Communications	cwalls@lcwc.co.lancaster.pa.us
Steve Rosenberry	PA Dept. of Health	strosenber@state.pa.us
Susan Hunter	Union County GIS	shunter@unionco.org
Tim Murphy	Columbia County GIS	tmurphy@columbiapa.org
Tom Farcht	Johnson Mirmiran & Thompson	tfarcht@jmt.com
Wade Gobrecht	York County Planning Commission	wgobrecht@ycpc.org
William Somplatsky	PENNDOT - Engineering District 11-0	wsomplat@state.pa.us

Tell someone about Height Modernization today!